possible grade and their errors properly stated on an accompanying correction card, such as is furnished by the United States Bureau of Standards at Washington, at a very small expense. A complete Weather Bureau station is rarely needed for such special studies.

CYCLONES AND ANTICYCLONES.

The following article on cyclones and anticyclones was written in response to a request from a correspondent, apparently a small schoolboy, for some information about cyclones and anticyclones. As other young readers of the MONTHLY WEATHER REVIEW may also wish information on the subject, the reply is here published.

The atmosphere is an envelope or layer of gas that we call air covering the whole earth just as the peel covers an orange. It is unlike the orange peel in that it is free to move, like water. The air is, in fact, a sort of ocean that flows above us.

The air, like other gases, is compressible, and the lower layers of the atmosphere, which have to bear the weight of the upper layers, are much denser than the upper layers because the weight of these upper layers is pressing down upon the layers underneath, just as the hay at the bottom of a stack or the layers of wool at the bottom of a pile of fleece are more closely packed.

You can readily understand that a crab in the ocean or a crawfish in a pond must feel the differences in pressure as the waves of water go over him, especially in the shallow water on the seashore, where waves five or six feet high frequently pass over places that had only a few inches of water a moment before. The changes in the pressure of the air are not so sudden nor so extreme. The average pressure is about fifteen pounds to the square inch, and in extreme cases a change of only a pound or a pound and a half takes place in the course of a day.

The pressure of the air is measured with an instrument called the barometer (from two Greek words, *baros*, weight, and *metron*, measure), whence barometric pressure is spoken of, meaning pressure measured with the barometer, and as the barometer is only used to measure atmospheric pressure, barometric pressure is simply pressure of the air.

The barometer most commonly used is called the mercurial barometer and consists of a piece of glass tube about a yard long, closed at one end by melting the glass together. This tube is held open end up, and filled with mercury, and a small bowl is also filled with mercury. The tube is tightly covered with the finger, turned end for end, and the open end is put under the mercury in the bowl and the finger taken away. The mercury in the tube runs out into the bowl until about 30 inches of mercury remain in the tube, leaving at the top an empty space. The pressures of the mercury in the tube and the air outside balance each other, in just the same way as the columns of water in the two arms of a U-shaped tube balance each other. When the pressure of the air becomes less, the pressure on the surface of the mercury in the bowl becomes less, and some of the mercury runs out of the tube into the bowl. In this case the barometer is said to fall, meaning that the top of its column of mercury is lower. When the air pressure becomes greater, the pressure on the surface of the mercury in the bowl becomes greater, and the mercury runs back up into the tube. Then the barometer is said to rise, meaning that the top of the column is higher. These changes are measured by placing a piece of metal marked like a ruler or yardstick beside the tube of the barometer. This is called the scale of the barometer, and because the scale is divided into inches the pressure is spoken of as being so many inches of the barometer: the inches are subdivided into tenths and hundredths. On the weather map lines are drawn through all the places where the barometric reading is the same. There are other kinds of barometers besides the mercurial barometer. A kind very frequently seen is the aneroid barometer (aneroid from *a*, without, and *neros*, wet, without fluid), which consists of a small metal box with a spring inside. When the pressure becomes greater the sides of the box are pressed together, and when the pressure becomes less the sides are pushed outward by the spring. The sides are connected by a thread to a hand that moves around a dial like the face of a clock. Barometers can be made with water instead of mercury, but then the tube has to be about 30 feet high. A difference of an inch in the height of the mercury in the barometer corresponds to a difference of about a half a pound of pressure to each square inch.

You may have noticed little whirlpools in the water of a brook or river, where the bank juts out or where the current flows around a log or stone. Perhaps you have also noticed places where the water seemed to be boiling up from below, and wondered if there might be a whirlpool upside down that was causing the water to come up from the bottom. Whirlpools like these frequently occur in the atmosphere, for it is not still like the water in a pond, but is moving in great currents or streams like water in a canal or river. One such stream flows high above the ground over the Northern Hemisphere in the Temperate Zone and another over the Temperate Zone of the Southern Hemisphere. Both of these flow from west to east. The air over the tropical regions of the earth between these two streams of air is almost calm, except down at the surface of the ocean where the trade winds blow, in the Northern Hemisphere from the northeast toward the equator, and in the Southern Hemisphere from the southeast toward the equator.

You can see that the United States is under a stream of air flowing from the west by watching the high, thin clouds called cirrus or "mare's tails," which generally come from a westerly direction, either northwest, west, or southwest.

Whirls are formed in these aerial streams just as whirlpools and uprushes are formed in the rivers and brooks, but as the rivers of air are much larger than the rivers of water so the whirlpools of air are much larger than the whirlpools of water. The little whirlpools in the brook or river are generally only a few inches in diameter and last but a few minutes, while they are carried along a few feet or yards. The whirls that are formed in the air are of all sizes, the largest ones are sometimes so large that they cover several States and sometimes a third or half of the whole United States; they last for several days and even for a week or more and travel great distances, some having been known to travel almost around the earth.

These big whirls in the air are of two kinds; in one the air at the surface of the earth flows inward toward the center of the whirl, rises, and when it gets high above the ground flows outward from the center. This kind of whirl is called cyclone (from the Greek word *kuklos*, which means whirling around). The other kind of atmospheric whirl is more like the whirlpool in the river for in it the air comes down from above with a spiral movement and spreads out over the land. This is the anticyclone, so called because it is opposite to the cyclone in many ways (*anti* is a Greek prefix, meaning opposed to, or contrary to), as stated in the opposite paragraphs in the following comparison of the state of things near the surface of the earth:

In the cyclone—	*In the anticyclone—*
The wind blows spirally inward toward the center.	The wind blows spirally outward from the center.
The air pressure is lowest at the center, for which reason cyclones are also called "lows".	The air pressure is highest at the center, and anticyclones are called "highs".
The air in cyclones is warm, especially at the front.	The air in anticyclones is cold, especially at the front.
The weather in cyclones is cloudy and rainy.	The weather in anticyclones is clear and dry.

On the same side of the equator whirls of the same kind (cyclones for instance) always turn or rotate around their centers in the same direction. In our Northern Hemisphere the direction of the inward and upward spiral movement of the air circulating around a cyclone is always opposite to the direction of the movement of the hands of a watch or clock as it lies face upward, that is to say, contraclockwise. In the Southern Hemisphere, the whirling movement of cyclones is with the hands of a watch, or clockwise.

Anticyclones, contrary to cyclones in other respects, are also contrary to them in the matter of the direction of whirling. Anticyclones rotate clockwise in the Northern Hemisphere, and counterclockwise in the Southern Hemisphere. Of course there is a reason for this rule about the direction of whirling, and that is that the direction of the whirl is given to it by the direction of the whirling of the earth rotating on its axis.

If you have a stationary washbowl with an outlet at the bottom, or even a large round bottle turned upside down, you can make whirlpools for study by filling the bowl or bottle with water, and then when you pull out the stopper the water will start whirling around.

The broad aerial stream that is generally flowing from west to east over the United States apparently carries cyclones and anticyclones along with it very much as the brook or river carries along its whirlpools. It is this succession of "highs" and "lows" with their opposite kinds of weather and wind that brings us our frequent changes from rainy to clear, warm to cold, and south wind to north wind.

The word cyclone belongs to the very large whirls in the atmosphere that I have described. There are other smaller atmospheric whirls that have special names; these are the hurricane, typhoon, tornado, and waterspout. I wish especially to make very clear to you the difference between a cyclone and a tornado, because many people use the word cyclone when they mean tornado, and when others use the word cyclone properly they are not understood. The word cyclone was first used about the year 1840 as a name for very large whirling storms, sometimes as much as five hundred miles across, that occur in the Bay of Bengal and the Indian Ocean. Storms like these also occur in the West Indies (south and southeast of the United States), where they were named hurricanes by the Caribbean Indians who inhabited the islands of the West Indies when they were discovered by Europeans, and the name was adopted by the early Spanish and Portuguese navigators and has been used ever since. Storms of the same kind occur in the Philippines and on the Chinese coast, where they have been called typhoons from ancient times.

The name cyclone was invented to describe the whirling character of these large whirlwinds that Englishmen found in India. It was brought home to England by them, and the large whirling masses of air that are carried along from west to east were called cyclones, and now the word cyclone belongs properly to large whirlwinds two or three thousand miles in diameter.

The word tornado is a Spanish word meaning "twister," and is applied to the dangerous whirlwinds that tear down houses and kill people. They are very small compared with the hurricane and cyclone, being generaly less than half a mile in diameter and are rarely carried more than forty or fifty miles, and do not last altogether more than an hour or so before they die away and disappear. They take only a few seconds to pass over any given point. Cyclones and hurricanes travel for many days and go thousands of miles and take from a day to three or four days to pass over a place. It is evident, then, that the cyclone and the tornado are two very different things, their similarity being that they are both whirling masses of air. The house cat and the tiger are alike in more respects, but there is no one who would call a cat a tiger, so the tornado should not be called a cyclone.—*E. R. M.*

CORRIGENDUM.

MONTHLY WEATHER REVIEW for July, 1905, Vol. XXXIII, page 318, line 12: For "temperature over Iceland" read "pressure over Iceland."

THE WEATHER OF THE MONTH.

By Mr. WM. B. STOCKMAN, Chief, Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and V.

The mean pressure for the month was highest over the middle and northern Plateau and the western portions of the middle and northern slope regions, with the crest over southern Idaho, southwestern Wyoming, and northeastern Nevada. The contour of the isobars inclosing this area of highest mean pressure closely approached the normal for the month, but the values were considerably greater. The area of secondary normal high pressure overlying the region about the southern portion of the Allegheny Mountains is not indicated on the chart for this month.

The mean pressure was lowest over northeastern New England, the location and values being about normal. A secondary area of low mean pressure overlay southern Arizona and extreme southern California. The normal low pressure over the northern portion of the north Pacific coast region was displaced by the high pressure area to the southeastward.

The mean pressure for the month was slightly below the normal in the southern portion of the Middle Atlantic States, South Atlantic States, Florida Peninsula, southeastern half of the east Gulf States, northern upper Lake region, extreme northern portion of the upper Mississippi Valley, and eastern and central North Dakota; elsewhere the mean pressure was above the normal, with departures ranging from +.10 to +.20 inch over the greater portion of the slope and Plateau regions.

Over the entire United States the mean pressure for December exceeded that of the preceding month, except in the southern part of the Peninsula of Florida, where no change occurred.

The greatest increases occurred over the slope, Plateau, and middle and south Pacific districts, where they ranged from +.10 to +.26 inch, the extreme changes, +.20 to +.26 inch, occurring over southwestern Wyoming, northwestern Colorado, central and northern Utah, northern Nevada (the crest), northeastern California, and southern Idaho.

TEMPERATURE OF THE AIR.

The mean temperature for the month was above the normal from central Montana, northeastern Wyoming, and western Kansas eastward to the Atlantic Ocean; also in southern Virginia, northeastern North Carolina, southern Florida, extreme southwestern California, and extreme northwestern Washington. In the remaining portions of the country the mean temperature was below the normal. Except in the region bordering on the western and southern line of demarcation between the plus changes, and the western, northern, and eastern lines of minus changes the departures exceeded 2°. Over eastern Massachusetts, southeastern Upper Michigan, Minnesota, excepting the west-central portion, northwestern Iowa, southeastern Montana, southern and northeastern Nebraska, and extreme southeastern South Dakota, the excess amounted to +4°, or more, and over extreme southeastern South Dakota